Mooreville Project
Soils and Watershed Input for Supplemental Information Report

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Soil and Watershed Actions

Additional road work may need to occur within the analysis area due to the impact of the fire and fire suppression. Road improvements would include additional drainage structures to the original analysis. The drainage feature includes critical dips, rolling dips, dips with leadoff ditches, and ditch relief culverts, and by out-sloping certain segments of road. Other activities include rocking inside ditches and rocking segments of road.

Any dozer line that was not rehabilitated properly that falls within the project should be restored to minimize the impacts to water quality.

Restrictions/Design Features

- More design specific design features are in the project management requirement table that contains all the resources' design features/mitigations. Below are some of the most crucial for soils and watershed.
    - See Table 1 for the RCA Heavy Equipment Exclusion Zone
    - Limiting Operating Period (LOP) (BMP 1-5, BMP 1-13) for soil moisture.
        - Conduct ground based harvest operations when soil is dry; that is, in the spring when soil moisture in the upper 8 inches is not sufficient to allow a soil sample to be squeezed and hold its shape, or will crumble when the hand is tapped. In the summer and early fall after storm event(s) when soil moisture between 2-8 inches in depth is not sufficient to allow a soil sample to be squeezed and hold its shape, or will crumble when the hand is tapped. Work on streams should occur during low flow (late summer)
    - Where skidding occurs on slopes greater than 15 percent scatter slash on skid trails to achieve at least 50 percent effective soil cover.
    - If effective soil cover is below the desired level of soil cover along streams, then leave slash material to increase soil cover. When cutting trees lop and scatter broken tops and limbs within 1 tree length of any stream.

Table 1. RCA Heavy Equipment Exclusion Zone Widths and Slope Restrictions

Stream Type	Equipment Exclusion Zone (EEZ) for Roadside Hazard Tree Removal and Salvage	
	Slope <35%	Slope >35%
Perennial streams	100 feet	Excluded
Intermittent streams	82 feet	Excluded
Ephemeral streams	25 feet	Excluded

Stream Type	Equipment Exclusion Zone (EEZ) for Roadside Hazard Tree Removal and Salvage	
	Slope <35%	Slope >35%
Special Aquatic Features (Reservoirs, wetlands, fens, and springs)	100 feet	Excluded
Riparian Features: dry meadows, seasonal wetlands	25 feet	Excluded

Hydrology Analysis

The analysis will look at the direct and indirect effects of proposed salvage treatments due to the Bear Fire. The original analysis is still relevant the information presented here is a supplement to the original analysis.

Direct and Indirect Effects of Vegetation Management Activities

Approximately 913 acres of the original 3,000 acres analyzed and authorized for management burnt due to the Bear Fire which is part of the North Complex incident of 2020. The primary treatment in the areas that burned is going to be hazard tree and salvage. The salvage is going to be done via mechanical thinning. A direct effect of the proposed action is that effective soil cover will be increased as a result of design features such as the broken tops and limbs of the felled trees will be left in place within tree length of any stream. Increasing the effective soil cover is an improvement over the existing condition where little effective soil cover is present to effectively stop erosion. The amount of increased soil cover is hard to predict and there is a probability that some units won't be able be able to achieve a minimum percent effective soil cover but still that would be an improvement. An indirect effect of implementing the project is that erosion and the amount of sediment entering Lake Oroville will be qualitatively lower. The design features and BMPs are intended to project the water quality while moving forward with the projects intent to salvage and remove hazardous trees. One example is that having a LOP on soil moisture and limiting the number of passes a rubber-tired skidder has over the same piece of ground in RCAs will help reduce the possibility of channelized flow while still increasing effective soil cover by leaving the broken tops and limbs. The implementation of the project is not expected to cause any direct and indirect significant negative effects to the waters of Lake Oroville. The original analysis of the treatments effects on hydrology is still relevant to the project.

Miles of Road Improved and Maintained

No major changes to this component of the analysis. The road prioritization for improvements remain the same. When more information comes in adaptive management may prioritize what road segments get implemented first in order to project water quality.

Table 2. Road Improvement Priority List

Road ID	Priority	Miles	Road ID	Priority	Miles
20N09	Low	0.8	21N16Y	High	0.4
21N05Y	High	0.3	21N37Y	Low	0.9
21N15	High	2.2	21N56	High	2.1
21N15A	Moderate	0.3	21N56B	Low	0.3
21N15Y	Low	0.2	21N69Y	Low	0.8
21N16	High	8.2	21N79	Moderate	0.3
21N16C	Moderate	0.5	21N86	Moderate	0.2

Cumulative Effects

The Cumulative Watershed Effects (CWE) analysis is based on the guidance from the Forest Service Handbook FSH 2509.22-Soil and Water Conservation, Region 5 Amendment (USDA Forest Service 1988b). Effects may be either beneficial or adverse and are a result of combined effects of multiple management activities within a watershed. Beneficial uses for waters in the project are identified below the RCO analysis. Alterations to watershed hydrology are believed to be the most probable mechanism for initiating these effects to aquatic habitat (USDA Forest Service 1988b). The Region 5 Forest Service Handbook amendment utilizes conceptual site disturbance coefficients called equivalent roaded acres (ERA) to track changes in the hydrologic functioning of watersheds. ERA coefficients are used to compare the effect of management activities (e.g. timber harvest or pile burning) to the effect of a road in terms of altering surface runoff patterns and timing. The sum of these coefficients represents the percentage of watershed in road surface that would produce the same effects as the existing or planned distribution of management activities (Berg et al, 1996).

Watersheds and stream channels have a natural capacity to absorb various levels of land disturbance without major adjustment to their function and condition. However, there is point where additive or synergistic effects of land use activities would cause a watershed to become highly susceptible to cumulative effects. This upper estimate of watershed “tolerance” to land use is described as the threshold of concern (TOC). When the sum of disturbances exceeds the TOC, water quality may be impaired for established beneficial uses, such as aquatic habitat. Stream channels and water quality can deteriorate to the point where adjacent riparian areas and wetlands become severely damaged.

Project level TOCs are estimated by considering the sensitivity of each analyzed watershed. Natural watershed sensitivity is an estimate of a watershed’s ability to absorb land use impacts without increasing the effects of cumulative impacts to unacceptably high levels (USDA Forest Service 1988b). For this project, the TOC ranges from 11 to 14 percent across all project specific watersheds. The ERA total of each watershed, expressed as a percentage of the watershed area, is compared to the TOC and reported as a fraction (percent) of the TOC. ERA totals in the range of 90 to 99 percent of TOC are considered to be approaching TOC, while those that are 100 percent or greater equal or exceed the TOC. The TOC does not represent an exact level of disturbance where cumulative watershed effects will begin to occur. Rather, it serves as an indicator of increased risk of significant adverse cumulative effects occurring

within a watershed. If a watershed is approaching or above the TOC, a more thorough analysis of the activities planned within the watershed is necessary.

The original analysis assumed that all the timber management activities would start and be completed in one year in 2021. The model looks at worst a case scenario that is used to identify watersheds that may need a closer look at cumulative watershed effects that may have a negative or adverse effect to beneficial uses. However, due to the Bear Fire implementation of the project is pushed to this year 2020. Table 3 shows the difference between the original analysis to that current supplemental analysis. The original analysis identified watersheds 6, 14, and 16 as being over TOC. Post Bear Fire the ERA model predicts that four other watersheds will be over TOC those watersheds are 13 and 17-19. However, based on professional judgement it's expected that watersheds 20, 22, and 23 will be over TOC because the model did not include any salvage on private that is expected this year. Based on the ERA model results and professional judgement it's expected that watersheds 6, 13, 14, 16-20 and 22-23 are over 100 percent TOC which triggers forensic monitoring for the proposed treatment units in those watersheds.

Forensic monitoring is a condition through the CVRWQCB when the Forest Service applies to be enrolled under the Waste Discharge Requirements General Oder for Discharges Related to Timberland Management Activities. This type of monitoring is triggered when watersheds are found to be over TOC. Forensic monitoring is defined as a visual field detection technique used in the winter period within the project area to determine the condition of installed management measures and to identify threatened or actual significant sediment discharges (CRWQCB 2017). "The goal of winter forensic monitoring is to locate potential or actual sources of sediment in a timely manner so that rapid corrective action may be taken where feasible and appropriate" (CRWQCB 2017). Forensic monitoring occurs at least two times in the winter and is triggered by storm events of a particular size (more details are referenced in the project file).

The result of 10 watersheds being over 100 percent TOC serves as an indicator of increased risk for cumulative effects. Close inspection of the type of treatments and timing within RCAs indicate that there is a low probability that water quality and its beneficial uses would be cumulatively impacted in a detrimental way. The overall effectiveness of 93.8 percent of timber associated BMPs from 2010-2012 demonstrate that sediment is unlikely to reach a stream. The design features, BMPs, and equipment exclusion zones around RCAs listed in the management requirements table in the project file will help minimize any impacts to water quality and cumulative effects to the watershed. Forensic monitoring will ensure that any kind of significant discharge of sediment is observed at any time in any Class I or Class II watercourse that corrective actions would occur to fix the failed management measures. The proposed activities are not anticipated to change the streams hydrologic function and condition where it would cause cumulative effects.

Based on the ERA modeling the cumulative effects of all past, present and future foreseeable activities within the analysis area, coupled with the implementation of the proposed action with BMPs, design features and forensic monitoring would not alter surface runoff patterns and timing enough to significantly impact water quality or affect beneficial uses of water.

Table 3. Percent TOC by Watershed

Watershed Number	Acres	Original Proposed Action Percent TOC	Post Fire Proposed Action Percent TOC	Increase Percent TOC due Bear Fire
1	788	7%	66%	59%
2	314	5%	89%	84%
3	953	73%	73%	0%
4	311	45%	45%	0%
5	565	94%	94%	0%
6	581	127%	127%	0%
7	1,411	53%	53%	0%
8	1,370	85%	85%	0%
9	971	74%	74%	0%
10	791	56%	56%	0%
11	1,014	62%	62%	1%
12	466	10%	71%	61%
13	1,019	26%	100%	73%
14	580	144%	144%	0%
15	1,147	93%	94%	1%
16	1,068	110%	122%	11%
17	759	29%	127%	98%
18	1,177	12%	123%	112%
19	1,395	21%	130%	109%
20	1,217	91%	95%	4%
21	936	44%	45%	0%
22	1,977	89%	93%	4%
23	2,117	18%	76%	58%
Watersheds that were expected to be over TOC in the original analysis before the fire.				
Watersheds that are expected to be over TOC post fire using original analysis plus the fire BARC layer.				
Watersheds that were modeled not be over TOC post fire but has significant private. The assumption is that they will do salvage therefore the assumption is that they will be over TOC.				

Soil Analysis

The original soils analysis looked at the soils hydrologic function, its ability to support plant growth and filtering-buffering function. The qualitative analysis will disclose the existing condition and compare that to the proposed activities post the Bear Fire.

Existing Condition Post Bear Fire Affects

The Bear Fire effected the Mooreville Project by burning approximately 913 acres out the 3000 acres authorized to be implemented in the original analysis. The fire burned approximately 30 percent of the project. Approximately 103.3 acres were rated as high, 363.7 acres as Medium, and 445.8 acres as low as indicated in Table 4. These acres discussed came from the Burned Area Reflectance Classification (BARC) GIS. The BARC GIS is a satellite-derived data layer of post-fire vegetation condition. The BARC has four classes: high, moderate, low, and unburned. This product is used as an input to the soil burn severity map produced by the Burned Area Emergency Response (BAER) teams. Therefore, the

number presented here should be referred to as a Modified BARC severity estimate, not an estimate of Soil Burn Severity because there were not enough field visits to complete a proper Soil Burn Severity Map.

Table 4. Project Acres Burned According to Modified BARC

Unit Number	Modified BARC Acres			Total	Percent Burned
	High	Medium	Low		
Service Work Units	40.8	128.2	227.1	396.0	42%
01	0	29.6	1.6	31.2	17%
02	0	4.8	0.1	4.9	6%
04	36.9	122.3	137.1	296.2	69%
05	0.1	48.7	32.8	81.6	66%
06	25.5	28.8	47.0	101.3	90%
07	0	1.1	0.1	1.3	2%
08	0	0.2	0.0	0.2	1%
Grand Total	**103.3**	**363.7**	**445.8**	**913**	

The Bear Fire impacted units 04 and 05 with more than 60 percent of the units burning. Unit 09 was 90 percent burned. Service work units within the fire perimeter burned either were completed burned or were partially burned. In the original analysis, soil surveys covered 48 percent of the project area. Units M01, M02, M04A, M04B, and M05 were the impacted the Bear Fire as indicated in Table 5 and Table 6. The soil survey unit numbers match the project unit numbers for the most part except for unit 04 was split into M04A and M04B. For example, project unit 01 is 17 percent burned (see Table 4) and soil survey unit number M01 is 17 percent burned as well.

Table 5. Soil Survey Units Impacted by Bear Fire

Soil Survey Number	Modified BARC Acres			Total	Percent Burned
	High	Moderate	Low		
M01	0.0	1.6	29.6	31.2	17%
M02	0.0	0.1	4.8	4.9	6%
M03					
M04A	28.8	76.9	49.5	155.2	95%
M04B	8.1	60.2	72.7	141.1	53%
M05	0.1	32.8	48.7	81.6	66%
M10					
M11					
M12					
M13					
Grand Total	37.0	171.6	205.4	414.0	
Soil survey unit did not burn in the Bear Fire.					

Table 6. Existing Soil Condition Measures Post Bear Fire

Soil Survey Number	Soil Texture	EHR	Effective Soil Cover	Soil Stability Rating	Fine Organic Matter	Surface Organic Matter Rating	Displacement	Soil Organic Matter (SOM) Rating	Compaction	Soil Strength Rating	Erosion	Soil Structure and Marco-porosity Rating
M01	Loam	Low	--	Poor-Fair	--	Poor-Fair	--	Poor-Fair	--	Fair	0%	Good
M02	Silty Clay Loam	Low	--	Poor-Fair	--	Poor-Fair	--	Poor-Fair	--	Fair	0%	Good
M03	Sandy Loam	Low	89%	Good	84%	Good	0%	Good	9%	Fair	0%	Good
M04A	Loam	Low	--	Poor-Fair	--	Poor-Fair	--	Poor-Fair	--	Fair	0%	Good
M04B	Silty Clay Loam	Low	--	Poor-Fair	--	Poor-Fair	--	Poor-Fair	--	Fair	0%	Good
M05	Sandy Loam	Low	--	Poor-Fair	--	Poor-Fair	--	Poor-Fair	--	Fair	0%	Good
M10	Silty Clay Loam	Low	90%	Good	83%	Good	0%	Good	2%	Good	0%	Good
M11	Sandy Loam	Low	91%	Good	83%	Good	3%	Good	7%	Fair	0%	Good
M12	Silty Clay Loam	Low	96%	Good	82%	Good	1%	Good	3%	Good	0%	Good
M13	Silty Clay Loam	Low	93%	Good	88%	Good	2%	Good	2%	Good	0%	Good
Soil survey units not impacted by the Bear Fire.												

The soil hydrologic function for the areas that did not burn in the Bear Fire remains the same. For the areas that burned its assumed that the soil indicators went from good to poor-fair as displayed in Table 6. The assumptions are the fire consumed most of the soil effective cover, fine organic matter, the landscape had various dozer lines go through the project which displaces and compacts the soils. Erosion is not an issue yet because no significant precipitation has occurred. The areas that weren't surveyed in the original analysis but fall within the Bear Fire perimeter the same assumptions can be made that most of the soil indicators would be rated from poor to fair.

Proposed Salvage Treatment

Direct, Indirect, and Cumulative Effects

The supplemental information report and decision is proposing salvage of the dead and hazardous trees due to the Bear Fire. All units that are within the fire perimeter will leave slash material to increase soil cover along streams. When cutting trees, lop and scatter broken tops and limbs within 1 tree length of any stream. The amount of slash that goes to landings will be minimized instead the material would be used for effective soil cover in order to promote soil stability. The slash placement will be prioritized on steeper slopes, areas along the riparian corridor, and skid trails. The percent increase in effective soil cover and organic matter is hard to predict but it would be an improvement from the existing condition and will help with soil stability and future soil nutrients. To minimize the amount of soil disturbance, logging systems will have to use existing landings and skid trials plus restrict the use of any heavy equipment to 35 percent. Where skidding occurs on slopes greater than 15 percent scatter slash on skid trails to achieve at least 50 percent effective soil cover. A soil moisture LOP would be in place for the use of heavy equipment which will minimize ruts and compaction therefore keep the erosion to a minimum. The soil indicators post salvage should slightly improve because in the high to moderately burned areas effective soil cover and fine organic matter measures will increase due to the design features discussed above. Over this winter (2020/2021) and the following year erosion is expected to occur in the burned units but by increasing the amount of slash on the landscape in key locations will help with erosion compared to not treating the landscape.

References

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